

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A radio frequency communication system for communicating signals, said system comprising:

a radiating transmission line having a first end and a second end;

a base station coupled to the first end, said base station comprising a base receiver for receiving a first communication signal at a first frequency from the first end;

at least two amplification units coupled to said transmission line at periodic locations for amplifying the first communication signal at the first frequency from previous amplification units in an upstream direction towards the first end, and said at least two amplification units having degradation detection units for detecting a degradation in the communication system between the at least two amplification units; and

wherein upon detection of a degradation in the communication system between any two amplification units, the amplification units detecting the degradation change the frequency of the first communication signal along the radiating transmission line between the two amplification units having detected the degradation from the first frequency to a predetermined first fault frequency to facilitate overcoming the degradation in the communication system.

2. The radio frequency communication system as defined in claim 1 wherein, different from any other frequency in the communication system between the two amplification units having detected the degradation.

3. The radio frequency communication system as defined in claim 1 wherein the first fault frequency is selected to facilitate radiation of the first communication signal from a first portion of the radiating transmission line located downstream of the degradation to a second portion of the radiating transmission line located upstream of the degradation.

4. The radio frequency communication system as defined in claim 1 wherein each amplification unit comprises:

a downstream connection for connecting a length of the transmission line in a downstream direction towards the second end of the transmission line, and, an upstream connection for connecting a length of the transmission line in the upstream direction towards the first end; and

wherein, upon detection of a degradation in the length of the transmission line at the downstream connection, the amplification unit commences to receive the first communication signal at the predetermined first fault frequency and upon no detection of a degradation in the length of the transmission line at the upstream connection, the amplification unit transmits the first communication signal at the first frequency.

5. The radio frequency communication system as defined in claim 1 wherein each amplification unit comprises:

a downstream connection for connecting a length of the transmission line in a downstream direction towards the second end of the transmission line, and, an upstream connection for connecting a length of the transmission line in the upstream direction towards the first end; and

wherein upon detection of a degradation in the length of the transmission line at the upstream connection, the amplification unit commences to transmit the first communication signal at the predetermined first fault frequency and increases a power level of the first communication signal to facilitate radiation of the first communication signal from a first portion of the radiating transmission line downstream of the degradation to be received by a second portion of the radiating transmission line upstream of the degradation.

6. The radio frequency communication system as defined in claim 1 wherein said base station comprises a base transmitter for transmitting a second communication signal at a second frequency into the first end;

wherein said at least two amplification units coupled to said transmission line at periodic locations amplify the second communication signal at the second frequency from previous amplification units in a downstream direction towards the second end of the transmission line;

wherein upon detection of a degradation in the communication system between any two amplification units, the amplification units detecting the degradation change the frequency of the second communication signal from the second frequency to a predetermined second fault frequency along the radiating transmission line between the two amplification units having detected the degradation to overcome the degradation in the communication system; and

wherein the second fault frequency differs from any other frequency in the communication system.

7. The radio frequency communication system as defined in claim 6 wherein the first fault frequency is lower than the first frequency and the second fault frequency is lower than the second frequency.

8. The radio frequency communication system as defined in claim 6 wherein the second fault frequency is selected to facilitate radiation of the second communication signal from a first portion of the radiating transmission line located upstream of the degradation to a second portion of the radiating transmission line located downstream of the degradation.

9. The radio frequency communication system as defined in claim 1 wherein the degradation detection units detect a degradation in the communication system by detecting a decreased power level in the first communication signal for a predetermined time period.

10. The radio frequency communication system as defined in claim 6 wherein the degradation detection units detect a degradation in the communication system by detecting a decreased power level in either the first communication signal or the

second communication signal for a predetermined time period.

11. The radio frequency communication system as defined in claim 1 wherein each amplification unit comprises:

a downstream degradation detection unit for detecting a degradation in the length of the transmission line at the downstream connection by detecting a decreased power level of a DC current received from the length of the transmission line connected in the downstream connection for a predetermined period of time; and

wherein after the predetermined time period, the downstream degradation detection unit sends a switch signal to a fault switch causing the amplification unit to commence to receive the first communication signal at the predetermined first fault frequency.

12. The radio frequency communication signal as defined in claim 1 wherein the predetermined first fault frequency differs from any other frequency in the communication system; and

wherein the degradation detection unit detects a degradation in the communication system by detecting transmission of any communication signal at the predetermined first fault frequency.

13. The radio frequency communication signal as defined in claim 1 further comprising:

a branching radiating transmission line having a first end, a second end and a branching unit for electrically coupling the first end of the branching radiating transmission line to the radiating transmission line, such that the first communication signals may pass to and from the branching radiating transmission line to the radiating transmission line either at the first frequency of the first fault frequency.

14. The radio frequency communication system as defined in claim 1 wherein a substantial part of the radiating transmission line is located below ground and the second end of the radiating transmission line is located remotely from the first end of

the radiating transmission line.

15. The radio frequency communication system as defined in claim 14 wherein the base station is above ground and the communication system is used to facilitate communication in a mine.

16. In a radio frequency communication system for communicating communication signals on a radiating transmission line, said radiating transmission line having a first end and a second end located remotely from the first end, said first end coupled to a base station comprising a base receiver for receiving a first communication signal at a first frequency from the first end, an amplification unit for facilitating communication of the communication signals, said amplification unit comprising:

a downstream connection for connecting a length of the transmission line in a downstream direction towards the second end of the transmission line;

an upstream connection for connecting a length of the transmission line in an upstream direction towards the first end;

an amplifier for amplifying the first communication signal in a direction towards the first end;

a degradation detection unit for detecting a degradation in the communication signal in the length of the transmission line at the upstream connection;

wherein upon detection of a degradation in the length of the transmission line in the upstream connection, the amplification unit commences to amplify and transmit the first communication signal at a predetermined first fault frequency and upon no detection of a degradation in the length of the transmission line at the downstream connection, the amplification unit continues to receive the first communication signal at the downstream connection at the first frequency.

17. The amplification unit as defined in claim 16 wherein the degradation detection unit detects degradations in the length of the transmission line at the downstream connection; and

wherein upon detection of a degradation in the downstream connection, the amplification unit commences to receive the first communication signal at the downstream connection at the predetermined first fault frequency.

18. The amplification unit as defined in claim 16 wherein the first fault frequency is different from any other frequency in the communication system along the length of the transmission line over which the degradation has been detected.

19. The amplification unit as defined in claim 16 wherein the first fault frequency is selected to facilitate radiation of the first communication signal from a first portion of the radiating transmission line, located between the amplification unit and the location of the degradation, and, a second portion of the radiating transmission line, located between the degradation and another amplification unit in the communication system.

20. A method for communicating communication signals utilizing a radiating transmission line having at least two amplification units coupled to the transmission line at periodic locations for amplifying communication signals along the radiating transmission line, said method comprising:

detecting a degradation in the communication signal along a link of the radiation transmission line between any two amplification units coupled to the radiating transmission line; and

at each of the two amplification units detecting a degradation in the communication system, altering a frequency of the communication signal along the length of the transmission line between the two amplification units having detected the degradation from a first frequency, used when no degradation is detected, to a predetermined first fault frequency different from the first frequency.

21. The method as defined in claim 20 wherein the first fault frequency is selected to facilitate radiation of the communication signals from a first portion of the length of the transmission line downstream of the degradation to a second portion of the

length of the transmission line upstream of the degradation unit.

22. The amplification unit as defined in claim 17 further comprising:

a first downstream filter for filtering communication signals at the first frequency;

a first downstream fault filter for filtering communication signals at the first fault frequency;

a switch for switching the first communication signals to the first downstream filter or the first downstream fault filter; and

wherein upon the degradation unit detecting a degradation in the first communication signal in the length of the transmission at the downstream connection, the switch switches the first communication signal from the first downstream filter to the first downstream fault filter.

23. The amplification unit as defined in claims 16 further comprising:

a first upstream filter for filtering communication signals at the first frequency;

a first upstream fault filter for filtering communication signals at the first fault frequency;

a switch for switching the first communication signals to the first upstream filter or the first upstream fault filter; and

wherein upon detection of a degradation in the first communication signal in the length of the transmission line at the upstream connection, the switch switches the first communication signal after amplification at the first upstream fault frequency from the first upstream filter to the first upstream fault filter.